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ABSTRACT

Two computer simulation models, arrived at by using System Dynamics (a systems analysis method for developing models of dynamic causal structures), have emerged from work on the dynamic differences between schools that are effective and ineffective for initially low-achieving children. One model focuses upon the differences between effective and ineffective schools and the other provides a basis for examining alternative policies for transforming ineffective schools into effective ones. Effective schools provide instruction that is appropriate and increasingly intense for low-achieving students in order to improve academic achievement. In ineffective schools, instruction is most appropriate and intense for students already achieving at or above their grade level. The first-stage model, which supports the notion that as a school improves achievement through improved instruction, it can also, over time, improve student motivation, provides a basis for developing a second-stage model intended to examine the interactions and feedback patterns affecting the expectations that in turn affect instructional responses to low achievement. Schools that are moving toward effectiveness are characterized by rising expectations for low achievers, strong leadership, an orderly, disciplined environment, and the ability to attract new staff committed to an effective school philosophy. (WD)

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THE DYNAMICS OF EFFECTIVE AND INEFFECTIVE SCHOOLING: PRELIMINARY REPORT OF A SYSTEM DYNAMICS POLICY STUDY

by Karl H. Clauset, Jr.
and Alan K. Gaynor
Boston University

Paper Presented at the Annual Meeting
of the American Educational Research Association
Los Angeles April 14, 1981

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The Dynamics of Effective and Ineffective Schooling:
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BACKGROUND

It has been more than a decade since Coleman, et al., found that "schools bring little influence to bear on a child's achievement that is independent of his background and general context." (Coleman, et al., 1966). Since then, there have been numerous methodological critiques of Coleman's work and, more recently, a growing body of empirical work which suggests that schools do make a difference. Both types of work have been comprehensively reviewed. (e.g., Averch, et al., 1974; Barr and Dreeben, 1977; Edmonds, 1979; Fowler, 1980; Rutter, et al., 1979) School effectiveness has been studied from two different perspectives. The first approach addresses the issue of the existence of effective schools. An effective school is generally perceived as one in which typically low-achieving students approach or exceed average middle-class norms of achievement in the basic skills of reading and mathematics. Very often, this approach involves case studies of small samples of schools (Benjamin, 1980; Brundage, 1980; Phi Delta Kappa, 1980; Salganik, 1980; Weber, 1971). Brookover, et al. (1980) used case studies to verify and elaborate on the conclusions of their study of 68 Michigan public elementary schools. In the Phi Delta Kappa study (1979), research data from large-scale studies by other researchers was used to collaborate evidence collected in the case studies.

Even though current research is based upon data representing no more than a few years in a school's history, it suggests the existence of a relatively small number of "lighthouse" schools spread throughout the country. These are schools in which students, often minority and/or poor students, achieve far better than home and SES variables would predict. Whether or not such schools exist as credible, stable entities in the long run is an issue that requires further longitudinal research.

The second research perspective focuses upon the operative dimensions of effective schooling. This research, itself, has taken two directions. Most of the extant research, some of it experimental in design, has studied teaching processes and their effects upon basic skills achievement. This body of work, characterized for example,

by the Beginning Teacher Evaluation Study in California (Fisher et al., 1978), has identified a number of process variables which are associated with basic skills learning, especially for traditionally low-achieving students (cf. Berliner, 1979; Bloom, 1976; Medley, 1979; Rosenshine, 1979). Of the various processes studied, it is the management and use of time that seems most important. This importance is underscored by the work of educational researchers and economists on resource allocation to and within schools (Dreeben & Thomas, 1980; Harnischfeger & Wiley, 1976; Thomas, 1977).

A smaller body of research is beginning to emerge which focuses upon the organizational context of effective instruction. This research attempts to describe the organizational properties of the effective school. (cf. Brookover, 1979; Edmonds, 1979; Rutter et al., 1979) The literature suggests that effective schools, in contrast to ineffective schools, are characterized by the following attitudes and properties:

1. A concern about the achievement gap for low-SES children and a commitment to either erase the gap or to keep it from spreading;

2. This concern and commitment is shared by both teachers and administrators;

3. There is a strong and consistent instructional leadership--usually the role of the principal;

4. The principal and staff manage the resources they have (time and people) efficiently;

5. There is an academic focus and a strong emphasis on the acquisition of basic skills. Efforts are made to maximize the amount of academic learning time;

6. The school environment is orderly and quiet;

7. Both the teachers and the principal have high expectations of success for all children. Staff members feel that they are in control and have the power to help every student achieve;

8. There is a careful monitoring of student academic achievement and this information is used to modify and improve the existing programs;

9. There is no one organizational or instructional pattern that ensures success;

10. Students spend less time in small group work,

independent activities, and unsupervised seatwork.

Three aspects of research on effective schools have been under-represented in the work done to date. The first is a focus on the interaction effects of variables. At a 1980 symposium of the American Educational Research Association titled, "Toward More Promising Paradigms for Understanding Schooling," a common call was sounded which emphasized the need to pursue the interaction of variables as they relate to effective schools. This call echoes that of Rutter, et al. (1979), who suggested that the "cumulative effect of . . . various social factors was considerably greater than the effect of any of the individual factors on their own." (emphasis in the original) Second, there is at this point in time no body of research which describes the process by which and the conditions under which schools move over time to levels of greater or lesser effectiveness. Third, perhaps more crucially, there is no clear body of theory which distinguishes at the level of deep structure between schools which are effective and ineffective for traditionally low-achieving students. Neither is there theory to account for changes in school effectiveness over time. The school effectiveness models that have appeared in the literature (cf. Bloom, 1976; Centra & Potter, 1980; Fisher et al., 1978; Harnischfeger & Wiley, 1976; Leinhardt, 1980) are, by and large, static linear models which minimize the importance of feedback effects.

The purpose of the current work has been to respond at the level of synthesis and theory-building to the need for a systematic conceptualization of (1) the dynamic differences between schools which are effective and ineffective for initially low-achieving children; (2) the feedback structure which governs the transitional path from one to the other; and (3) the interaction effects among key variables. In addition, we have translated the emerging theory into two computer simulation models: one to focus simply upon the dynamic differences between effective and ineffective schools; the second to provide a basis for examining alternative policies for transforming ineffective schools into effective ones. The simulation models help to assess the theory's consistency with extant knowledge, its recognizability to experienced observers, and its utility in examining policies to increase school effectiveness.

In this paper, which constitutes a preliminary report of work still in progress, we will describe (1) the essential theoretical perspective which has emerged from reviewing available research findings, (2) the results of our work with a simple, first-stage model to represent and test that perspective, and (3) our current conceptualization of a more detailed model whose purpose is to facilitate the examination of trade-offs among alternative policies to move schools toward conditions of greater effectiveness.

A THEORETICAL PERSPECTIVE ON THE DIFFERENCE BETWEEN EFFECTIVE AND INEFFECTIVE SCHOOLING

An important epistemological assumption underlying this work and all work in System Dynamics [1] is that theory transcends simple description, no matter how richly textured the description may be. Theories are second-order descriptions. They describe not what is, but how what is comes to be. They are explanatory. Theories represent efforts to describe the developmental dynamics by which phenomena change over time.

From this perspective, theoretical explanations in System Dynamics are structural in nature. That is, they seek to explain the causal dynamics of problems in terms of the dominance--and shifting dominance--over time of feedback structures. [2] For the system dynamicist, the most highly aggregate explanation of the causal dynamics of a problem is referred to as the "dynamic hypothesis." In the following paragraphs, we define the "effective schooling problem"

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[1] System Dynamics is a particular form of systems analysis which was developed at M.I.T. during the late 1950's and has been refined in a variety of applications over the last quarter century. It includes a set of tools and techniques--and an over-arching perspective--for developing computer simulation models of dynamic causal structures. The over-arching perspective is the "inward paradigm," a perspective emphasizing the importance of feedback as the central dynamic of problem systems.

For a more detailed introduction to System Dynamics see Jay W. Forrester, Principles of Systems, (Cambridge, MA: MIT Press, 1968) or, even better, George P. Richardson and Alexander L. Pugh III, Introduction to System Dynamics Modeling with Dynamo, (Cambridge, MA: MIT Press, in press).

[2] Feedback structures are of two general types. So-called "positive" feedback structures include causal relationships among variables which are mutually self-reinforcing. The relationship between wages and prices operates within the dynamics of inflation and depression to illustrate the concept of positive feedback. "Negative" feedback structures are characterized by their goal-seeking behavior. A thermostat system, for example, is a negative feedback system. In such a system, the effect of one variable on another is the opposite of the countereffect of the second variable upon the first. In the thermostat system, the heater goes on as the temperature goes down and off as the temperature goes up. Whereas positive feedback systems are characterized by runaway behavior such as inflation, negative feedback systems tend to stabilize values around a goal, such as the thermostat setting.

which we are addressing and our dynamic hypothesis about it.

The Effective Schooling Problem

The first task for the system dynamicist involves defining the problem as precisely as possible. Problems are defined in terms of discrepancies over time between existing and desired conditions. This implies the specification of indicators of the problem, preferably in quantitative form, and the depiction of the problem discrepancy as a phenomenon which persists over time.

For many educators (and others concerned with education) the continued failure of most schools to educate effectively initially low-achieving students (mainly students of minority and low SES status) constitutes a significant educational problem (cf. Edmonds, 1979; Kozol, 1967; Silberman, 1970). The assertion of such a problem implies the existence of a perceived discrepancy between the historical level of achievement (in reading, for example) and some "desired" level of achievement. Thus it is common in the literature on effective schooling to find references to the persistent, and widening gap in reading achievement between poor and middle-class children.

This oft-cited "gap" is typical of a set of discrepancies between observed and desired indicator trends by which system dynamicists define problems. This discrepancy can be displayed in the form of graphs. One could plot over time, for example, the growing discrepancy in reading scores of initially poor readers from grade level

norms as they proceed through school (see Fig. 1).

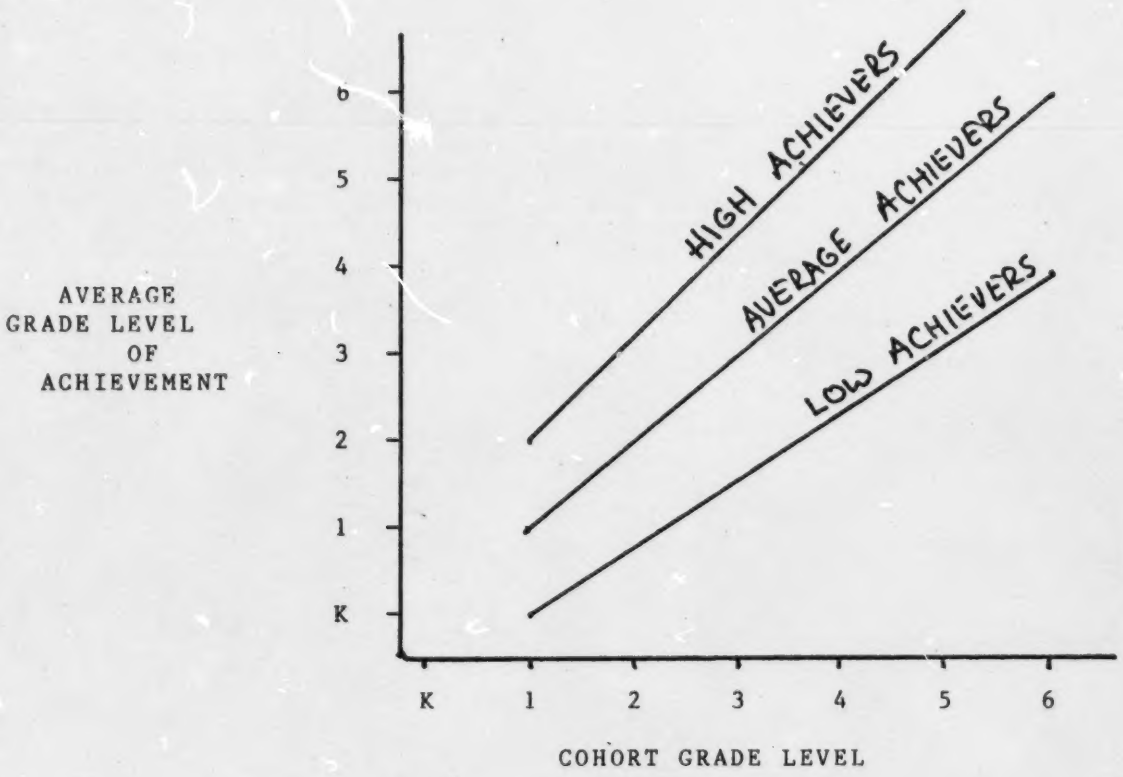

Fig. 1. REFERENCE BEHAVIOR MODE FOR THE FIRST-STAGE MODEL.

The problem could also be displayed graphically as the continued discrepancy over many years in the average sixth grade reading scores of cohort groups whose initial reading or reading readiness scores were high, average and low at

the time they first entered school (see Fig. 2).

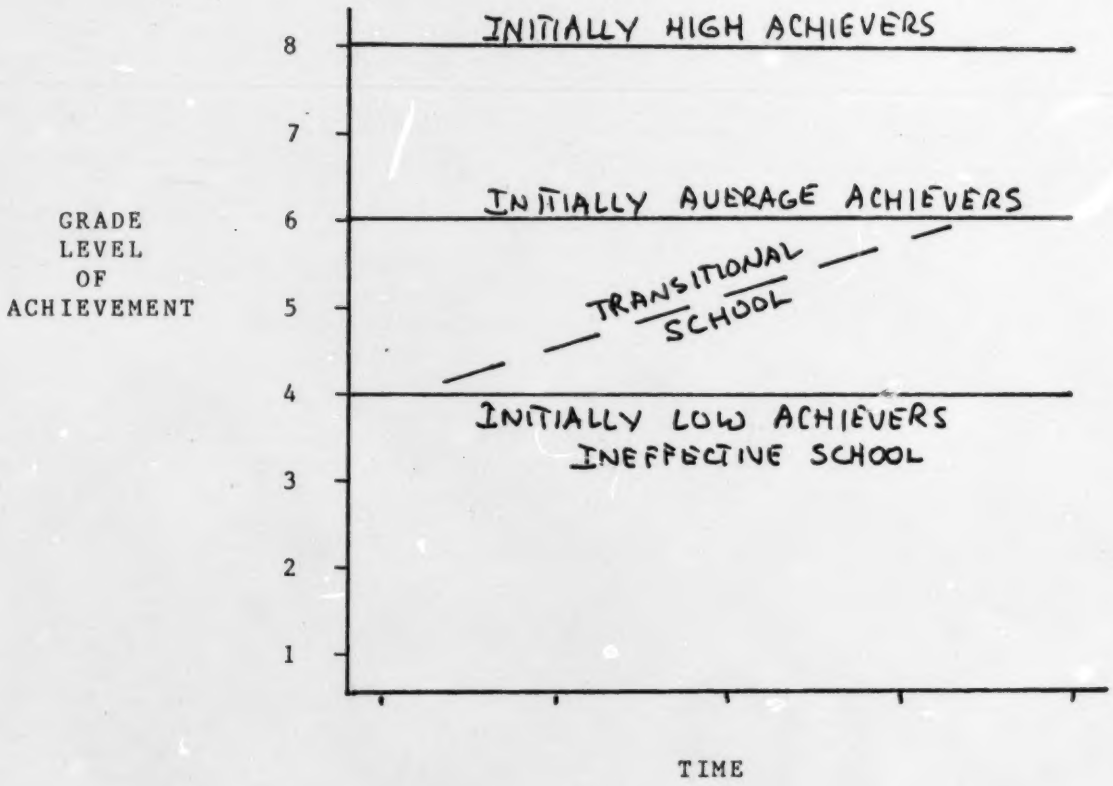

Fig. 2. Average Sixth-Grade Reading Achievement Scores Over Time of Initially High, Average-, and Low-Achieving Cohort Sub-Groups in Ineffective and Transitional Schools.

Graphs of this kind are usually called "reference behavior" graphs. They depict the problem graphically in ways which can be referred to later in analyzing the perceived causes of the problem and, eventually, in assessing the degree to which the model is able to reproduce the problem it was constructed to address.

The Dynamic Hypothesis

After defining the problem and its related reference behaviors, it is necessary to have a broad sense of the essential dynamics of the problem system. One must imagine, without a lot of detail, the basic elements which are

causing the problem and the fundamental causal feedback relationships among them which can be hypothesized as producing the problem over time. This is the dynamic hypothesis.

In the problem of the widening reading achievement gap described above, we argue that the fundamental difference between schools which are effective and ineffective for initially low-achieving children lies in the relationship between Observed Achievement and the Intensity and Appropriateness of Instruction which the school delivers to different achievement groups. Based upon considerable research on "Direct Instruction," [3] it is assumed that in all schools, effective and ineffective, there is a direct causal relationship between the intensity and appropriateness of instruction and the rate at which children, especially poor children, learn to read (Benjamin, 1980; Medley, 1979; Rosenshine, 1979; Salganik, 1980). We hypothesize that effective schools provide instruction to low achieving students which is appropriate and more intense in order to bring their reading achievement up to grade level (see Fig. 3). In these schools, grade level performance is the norm for all but clearly exceptional children. [4]

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[3] Direct instruction has been defined (c.f., Rosenshine (1979)): as being (1) academically focused, (2) teacher directed instruction using sequenced and structured materials, (3) grouping students for learning (where appropriate and where close monitoring and supervision can be provided), (4) emphasis on factual questions and controlled practice, and (5) careful management of students during seat-work.

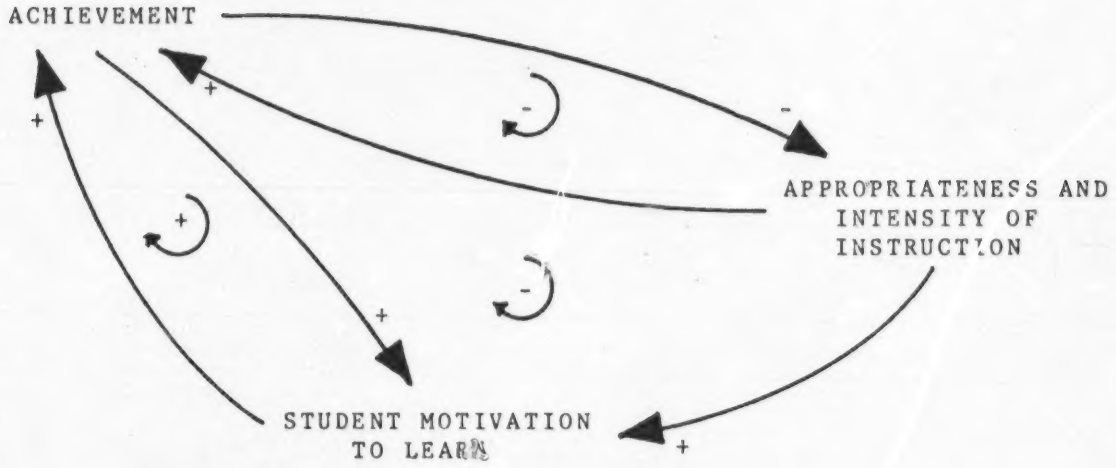

Fig. 3. The Dynamic Structure of the Effective School for Low Achieving Students.

In the ineffective school, instruction is most intense and appropriate for children whose achievement is already at grade level or above and increasingly less intense and appropriate for children who read further and further behind grade level (see Fig. 4). The expectations for low achieving students are below grade level. Teachers assume they cannot overcome the family and environmental conditions that contributed to the initially low achievement. Schools cannot make a difference and the low achievers are "written off".

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[4] The plus and minus signs in the figure indicate the polarity of the relationship between two variables. For example, a plus sign between motivation and achievement means that as motivation increases, achievement will also rise and as motivation decreases, achievement decreases. The minus sign between achievement and instruction means that as achievement falls, instruction becomes more appropriate and intense, and vice versa.

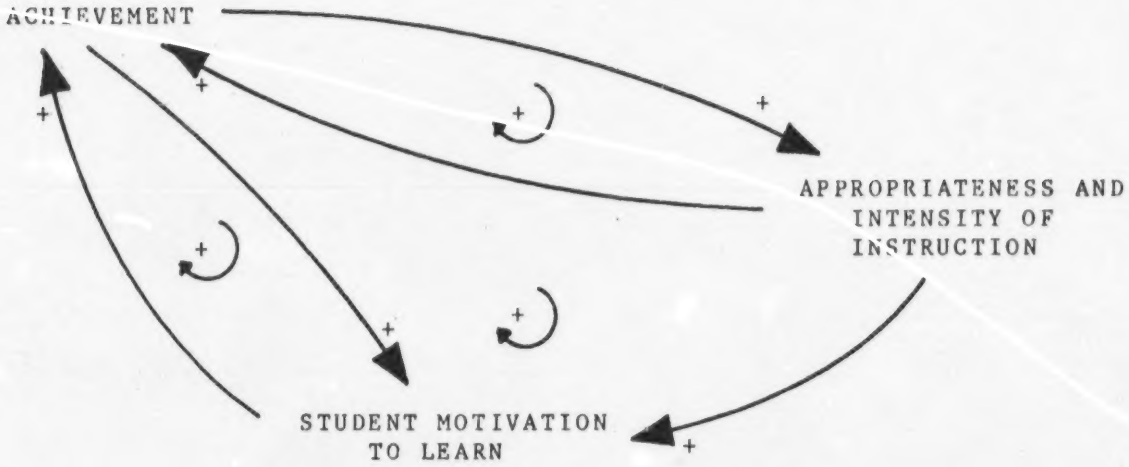

Fig. 4. The Dynamic Structure of the Ineffective School for Initially Low Achieving Students.

Thus, the "dynamic hypothesis" is that effective schools are characterized by "negative feedback" between Observed Achievement and Appropriateness and Intensity of Instruction (where lower achievers get more intense instruction) and ineffective schools are characterized by "positive feedback" (in which lower achievers get less appropriate and intense instruction). Effective schools exhibit goal-seeking behavior. Grade level standards constitute the performance goals for initially low-achieving students. Ineffective schools, in contrast, are characterized by self-reinforcing patterns of success (for initially high-achieving students) and failure (for initially low-achieving students). (See footnote [2], Supra, pp. 4.)

The First-Stage Model

A model was constructed to represent the dynamic hypothesis in its simplest form (as indicated in Fig. 3 & 4). This was the first-stage model. The purpose of formulating this model was to examine the extent to which the dynamic hypothesis, with all its simplifying assumptions, could account for the achievement patterns observed historically in effective and ineffective schools. Specifically, we were interested in seeing whether the first-stage model, when run on the computer, would plot out achievement scores for initially high-, average-, and low-achieving students which were consistent, over six years of elementary schooling, with

the patterns illustrated in the Reference Behavior Graph shown in Fig. 1 (Supra, p. 6). [5]

First-Stage Results

Three test runs were made with the first-stage model. The first of these, the Base Run, was designed to test the extent to which the model was able to reproduce the reference behavior (see Fig. 5).

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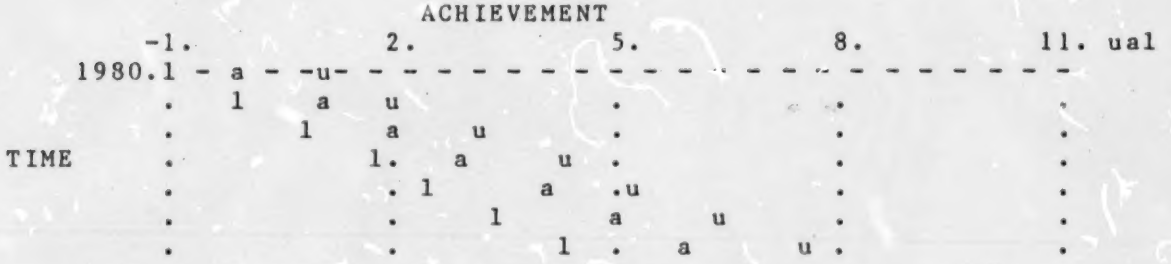
[5] At this point, it may be useful for the reader to take particular note of the two Reference Behavior Graphs (Figs. 1-2, Supra, pp. 6-7) They represent two related views of effective schooling. The first graph (Fig. 1) displays the typical patterns of progress through elementary school of a single peer cohort, broken out into three sub-groups based upon initial achievement. The dynamic hypothesis speaks essentially to this reference behavior. It suggests a structure which can account for these patterns of differential achievement in effective and ineffective schools. However, implicit in this structure and in these patterns of differential achievement of a single age-cohort is another set of patterns which describes the achievement of successive age-cohorts in the school over long periods of time. The longitudinal effectiveness of the school in teaching initially high-, average-, and low-achieving students can be represented, for example, by depicting the average 6th-grade achievement of each sub-group each year for multiple years. The second Reference Behavior Graph (Fig. 2) addresses this issue. Whereas the first-stage model is directed toward examining the dynamics of single cohort progression, the second-stage model, to be described later in the paper, is directed toward examining the dynamics of changing school effectiveness over time.

Fig. 5. FIRST-STAGE MODEL: BASE RUN
taii=.85,.9,.95,1,1.05,1,.95

u = upper cohort achievement
a = average cohort achievement
l = lower cohort achievement

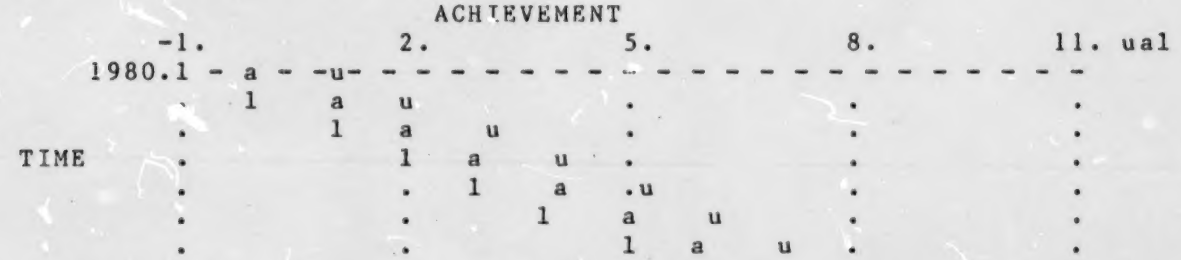


It can be seen that the base run of the first-stage model closely approximates the reference behavior. The initially-average achievers proceed normally from grades one to six. Average achievement is right on grade level. Initially-high achievers, over the six years of elementary schooling, widen their achievement advantage over the initially-average achievers while the initially-low achievers fall further behind. This is the classic picture of cohort progression in a traditional (i.e., ineffective) school.

The next two model runs represent efforts to alter the relationship between achievement and the appropriateness and intensity of instruction for students achieving below grade-level standards. The first three numbers in the "table function" (shown in the figure headings) affect instruction for low-achieving students. Initially, in the Base Run (Fig. 5), the table values for low-achievers are less than one, representing the diminished appropriateness and intensity of instruction (e.g., actual engaged time). Research shows this is typical of low-achievers in ineffective schools (Brookover, et al., 1979; Rist, 1970; Stallings, 1980). Bidwell and Kasarda argue, for example, that there are forces operating within the instructional units that cause stratification of resources among students in different achievement groups (1980, p. 413). In Policy Test No. 1 (Fig. 6), the results are shown of a moderate shift in these table values to values above one.

Fig. 6. First-Stage Model: Policy Test No. 1
Creating Negative Feedback for Low Achieving Students
and No Feedback for High Achieving Students
Between Achievement and Instruction
t taii=1.1,1.08,1.03,1,1,1,1

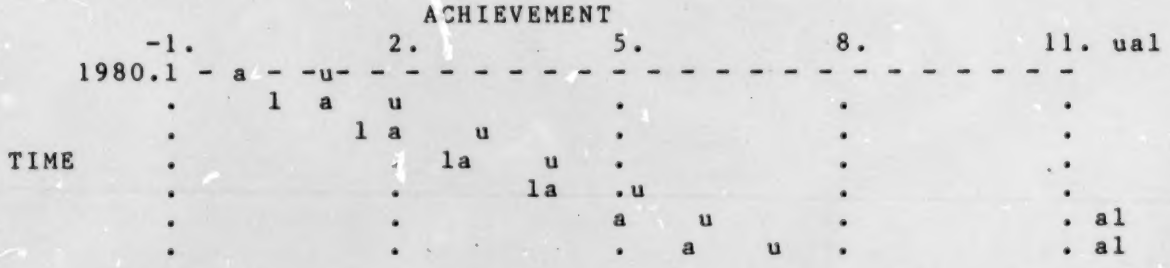
u = upper cohort achievement
a = average cohort achievement
l = lower cohort achievement



This structural change produces only the most modest of results, hardly discernible on the graph. One might be tempted to reach the not unusual conclusion that there is little the school can do to significantly affect the poor learning of these students. However, the next policy run suggests an alternative hypothesis. In this run (Fig. 7), the table values are strengthened, representing a stronger effort by the school to intensify instruction systematically for low-achieving students.

Fig. 7. First-Stage Model: Policy Test No. 2
Strengthening Negative Feedback for Low Achieving Students
and Maintaining No Feedback for High Achieving Students
Between Achievement and Instruction
t taii=2,1.7,1.4,1,1,1,1

u = upper cohort achievement
a = average cohort achievement
l = lower cohort achievement



An explanation consistent with a detailed examination of the model dynamics suggests not that initially low-achieving children are incapable of learning but rather that, as Bloom suggests, initial low achievement leverages against further learning. Equality of learning outcomes may require inequality of treatment at certain stages of the learning process if children are to attain equality of outcome (Bloom, 1976, pp. 215-217).

What the model suggests is that deliberate countermeasures on the part of the school must be effective enough to overcome the aversive effects of low motivation, itself an effect of previous low achievement. Figs. 3 and 4 display the presumed unalterable reality of the mutual reinforcement of achievement and motivation. The reciprocal relationship between achievement and motivation is taken theoretically to be part of what can be called the "physics of reality." The school can't change the relationship, itself, but to the extent that it can improve achievement by improving instruction, it can also, over time, improve student motivation (Atkinson et al., 1976; Kolesnik, 1978; Russell, 1971; Watson, 1963). Thus the rewards of skillful and the penalties of incompetent instruction would seem to be visited exponentially upon the students, especially the low-achieving students.

A THEORETICAL PERSPECTIVE ON THE TRANSITION FROM INEFFECTIVE TO EFFECTIVE SCHOOLING

Having examined and tested our dynamic hypothesis about the primary structural differences between effective and ineffective schooling, our next tasks were (1) to elaborate in sufficient detail the nature of the interactions around expectations that produce different instructional responses to low-achievement in effective and ineffective schools and (2) to represent enough structural elements--e.g., of teaching, learning, and leadership--to permit the analysis of different strategies for producing more effective schools. We have been particularly interested in analyzing the strategic tradeoffs under conditions of limited resources.

Resources are important (as Policy Test No. 2 (Fig. 7) shows). If enough resources can be channeled to initially low achieving students, their performance can be raised to grade level standards. But from what source do these resources come? How should they be allocated? We wanted to formulate a model which would facilitate consideration of the effects on the transition rate of alternative decision rules about the allocation of staff and administrative time (1) between instructional and non-instructional activities, (2) between reading and other subjects, and (3) among the high-, average-, and low-achieving groups of students. What are the relative trade-offs, for example, of allocating additional time to dealing directly with student behavior vs. putting more time into instruction or staff development? What are the likely effects, short- and long-term, of shifting instructional time from other subjects to reading? Is it more effective in the long run for the principal to invest time in instructional leadership or in seeking external resources for the school, etc.?

To address these kinds of policy issues, we formulated a second-stage model. This model had to incorporate considerably more structural detail than the first-stage model. The kinds of policy questions listed above guided our decisions about the level of detail and the inclusion or exclusion of variables in the model. In the next section of the paper, we describe the major characteristics and assumptions of the second-stage model.

General Structure

Schools exist to provide instruction. This process is illustrated in Fig. 8. Teachers have expectations for

student achievement.

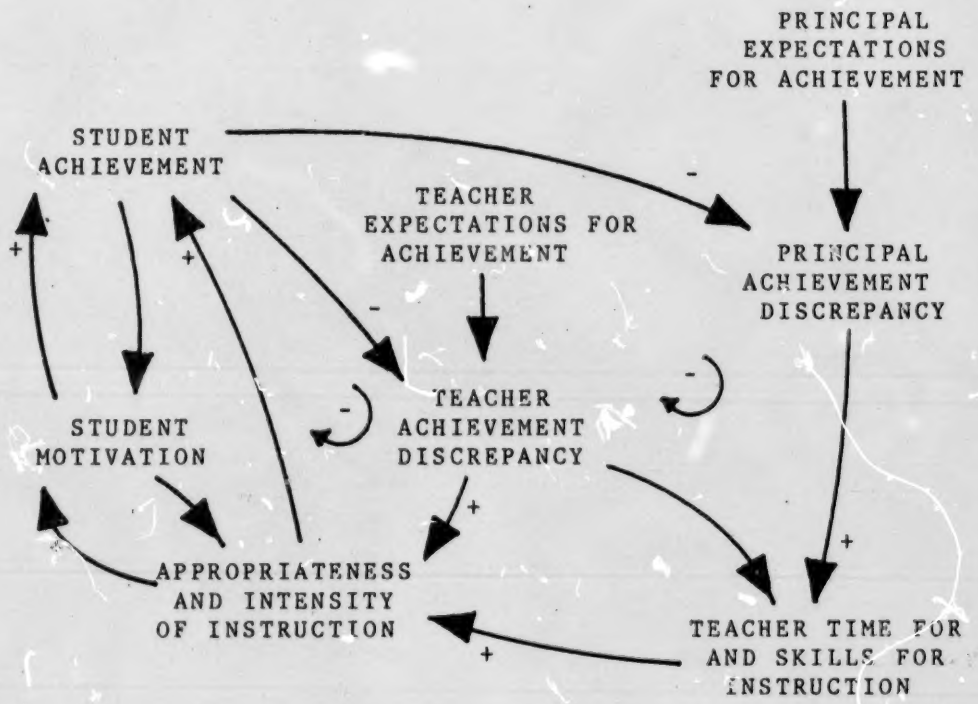


Fig. 8. Achievement and Instruction: The Basic Feedback Structure of Schools.

If there is a gap between present student achievement and the expectations for achievement, teachers will modify the appropriateness and intensity of instruction they deliver to the students. Changes in instruction will affect student motivation and achievement. The quality and amount of instruction a student receives over time will be sufficient to keep student achievement at the level of teacher expectations. Principals also have expectations for achievement. They work to modify teacher skills and the amount of time that teachers spend on instruction which influences the appropriateness and intensity of instruction, and, therefore, student achievement. Fig. 8 also indicates the important role of student motivation in the instructional process. Student motivation both affects and is affected by the instructional process. It affects the rate of learning for students and is, itself, affected by the level of student achievement.

These feedback loops exist in all schools. The primary difference between effective and ineffective schools lies in the nature of the expectations that teachers and principals have for students. This difference is found repeatedly in the literature (Benjamin, 1980; Brookover et al., 1979; Edmonds, 1979; Phi Delta Kappa, 1980; Salganik, 1980; Silberman, 1970; Weber, 1971). In an effective school, teachers and the principal maintain high expectations for the achievement of all students except those who are clearly exceptional. They assume that regardless of family background or social class characteristics all children can learn at a normal rate and can achieve standard levels of performance during their years of schooling. In an ineffective school, expectations for achievement are neither high nor fixed. Children who enter school with a lower level of reading readiness or who are from lower socio-economic classes (Rist, 1970) are categorized as low achievers. It is assumed that there is little the school can do the offset the impact of preschool, family, and environmental conditions.

A crucial difference between effective and ineffective schools lies in their expectations for initially low achieving students (see Fig. 9).

Fig. 9. The Relationship between Student Achievement and Expectations in Effective and Ineffective Schools.

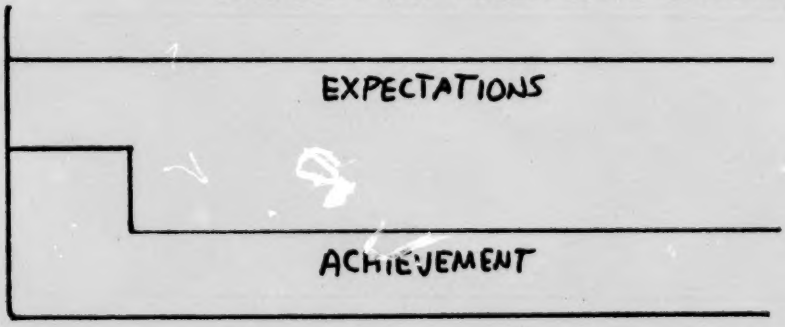


Fig. 9A. The Effective School: No Effect of Declining Student Achievement on Teacher-Principal Expectations for Student Achievement.

(Figure Continued)

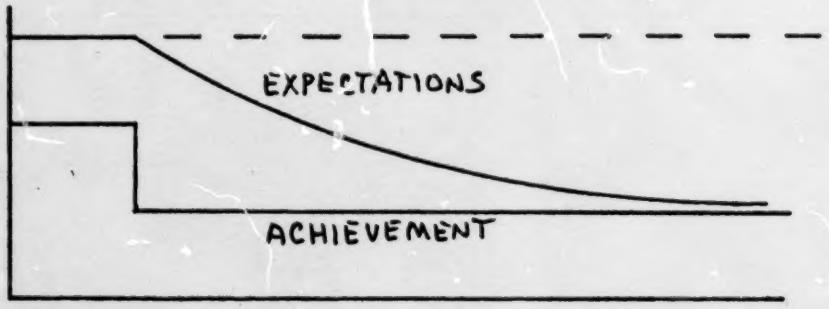


Fig. 9B. The Ineffective School: Declining Teacher-Principal Expectations for Students Follow Declining Student Achievement.

Imagine that there was a instantaneous drop in student achievement. This might occur if, for example, the entire student population of the school were replaced from one day to the next with students whose achievement level was far lower than the students they replaced. In an effective school, teacher expectations for the students do not change. In an ineffective school teacher expectations gradually decline as teachers realize that they are dealing with a new group of students who have a lower level of achievement. Teachers readjust their expectations to the new level. The implications of this difference are important.

In an effective school the discrepancy between achievement and expectation is large. Consequently the staff works harder to try to provide more appropriate and more intense instruction to close the gap. In an ineffective school the gap is smaller because expectations are falling. The staff is "willing away" the problem. Because the gap is narrowing, there is no need to provide as much effort for instruction as in the case of the effective school. Consequently the students receive less appropriate and less intense instruction in the ineffective school. In an effective school, the extra effort would begin to raise achievement. In the ineffective school, achievement tends to fall even further.

It is this difference in expectations that produces the different structures depicted in Fig. 3 & 4 and tested in the first-stage model. Figure 8 depicts, in essence, a more detailed picture of the feedback structure of an effective school, which was depicted in Figure 3. If one traces the

polarity of the linkages in both figures, as achievement falls, the appropriateness and intensity of instruction increases. Expectations are independent of achievement.

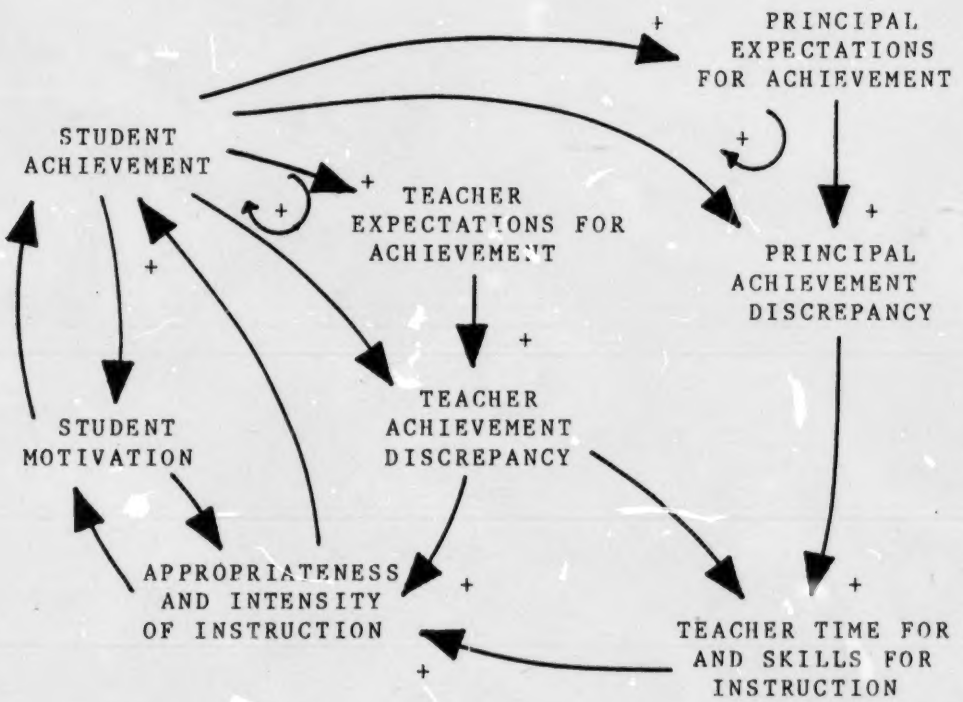


Fig. 10. Achievement and Instruction: The Feedback Structure of Ineffective Schools.

Figure 10 represents the feedback structure of an ineffective school. Expectations depend on achievement. As achievement falls, so do expectations--precisely the behavior described in Figure 9. Because of the addition of this positive link between achievement and expectations, as achievement falls, instruction becomes less appropriate and less intense. This is the same feedback structure as that in Figure 4.

As the discussion above suggests, we view expectations as a crucial difference between effective and ineffective schools. We tested the importance of this difference by adding a formulation for teacher expectations to the first-stage model. We found that the different sets of expectations for effective and ineffective schools produced the same achievement patterns as those shown in the original

first-stage model output (see Figs. 5 and 7, Supra, pp. 12 and 14).

The basic instructional process in schools is not as simple as Figure 8 would suggest. From Figure 8 one could conclude that the way to bring about a more effective school is to increase the time the teachers spend on instruction and to increase their skills through staff development. Yet requiring more staff development and instructional time without decreasing other duties such as maintaining discipline and clerical/administrative tasks means increasing teachers' workload. One demands more work in the same amount of time. A heavy workload over a prolonged period of time increases the likelihood of teacher "burn-out". With "burn-out", teachers don't work as hard, they "go through the motions" and, as a consequence, teacher effectiveness and the appropriateness and intensity of instruction fall (Bardo, 1979 & Walsh, 1979). As appropriateness and intensity of instruction falls, achievement will fall. This will result in more pressure on teachers to put more time into instruction, again increasing the pressures on workload. [6]

There is an additional effect of less appropriate and less intense instruction. As motivation falls the number of behavior problems in the school starts to rise. Teachers have to spend more time on discipline which also increases workload pressures. Consequently, teacher effectiveness falls and instruction becomes even less appropriate and intense. Declining school-wide behavior begins to reduce directly the amount of time teachers have for instruction. The result of this additional feedback structure as suggested in Figure 11 is to set off a downward spiral of falling motivation, falling achievement, increasing

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[6] The scenario described here presumes that "workload" incorporates two operative dimensions: (1) actual work done and time spent doing it and (2) the psychological press of expectations for doing work, whether such expectations are self- or other-imposed and whether the work is actually done or not. Thus, even when, as a consequence of burn-out, teachers may do less work, they still may experience a higher workload from the psychological press of growing expectations to meet the needs of students who are not learning as the teachers perceive that they should be learning. Teachers in schools with high expectations for all students are especially vulnerable to this psychological press. (Teachers in schools with low expectations for low-achievers are more protected from this form of burn-out. In such schools, responsibility for low achievement is displaced onto the students, their families, and their cultural environments.)

pressures on the teachers, increasing teacher burn-out and greater and greater difficulty in providing appropriate and intense instruction (Duke & Meckel, 1980).

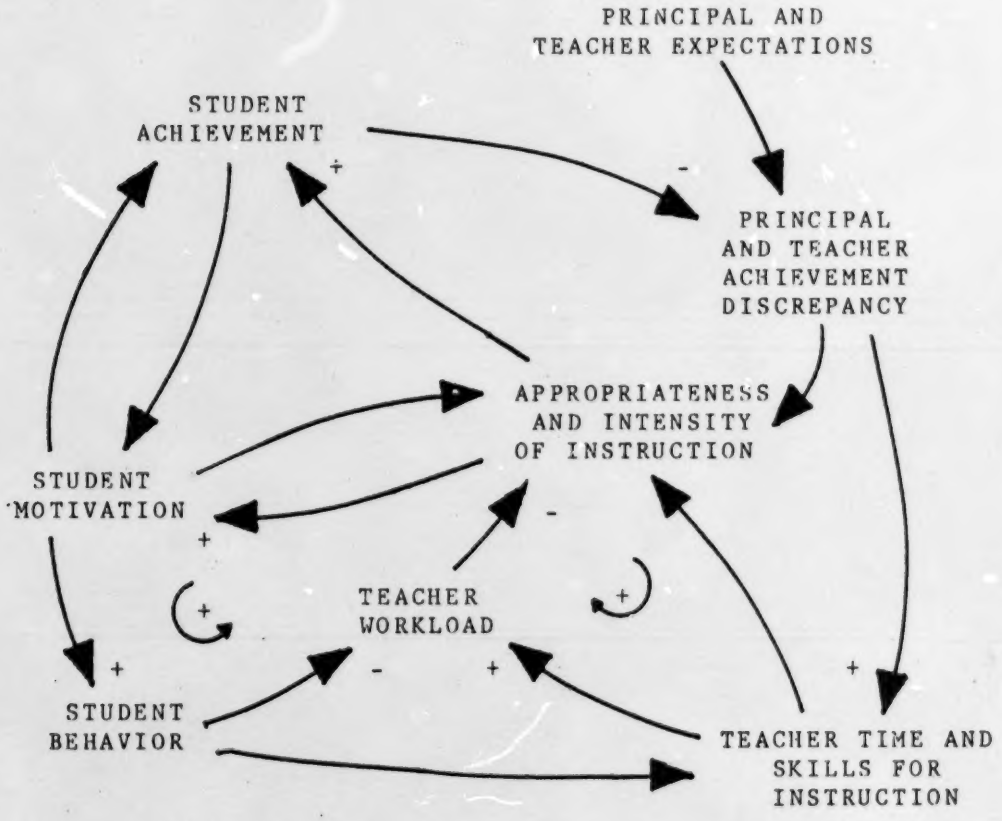

Fig. 11. The Impact of Teacher Workload

This diagram points up the fact that there are very real constraints on the ability of a school staff to provide appropriate and intense instruction for those groups of students in the school who are in the greatest need. A similar set of constraints operate on the principal as Fig. 12 illustrates. (Burruss, 1978)

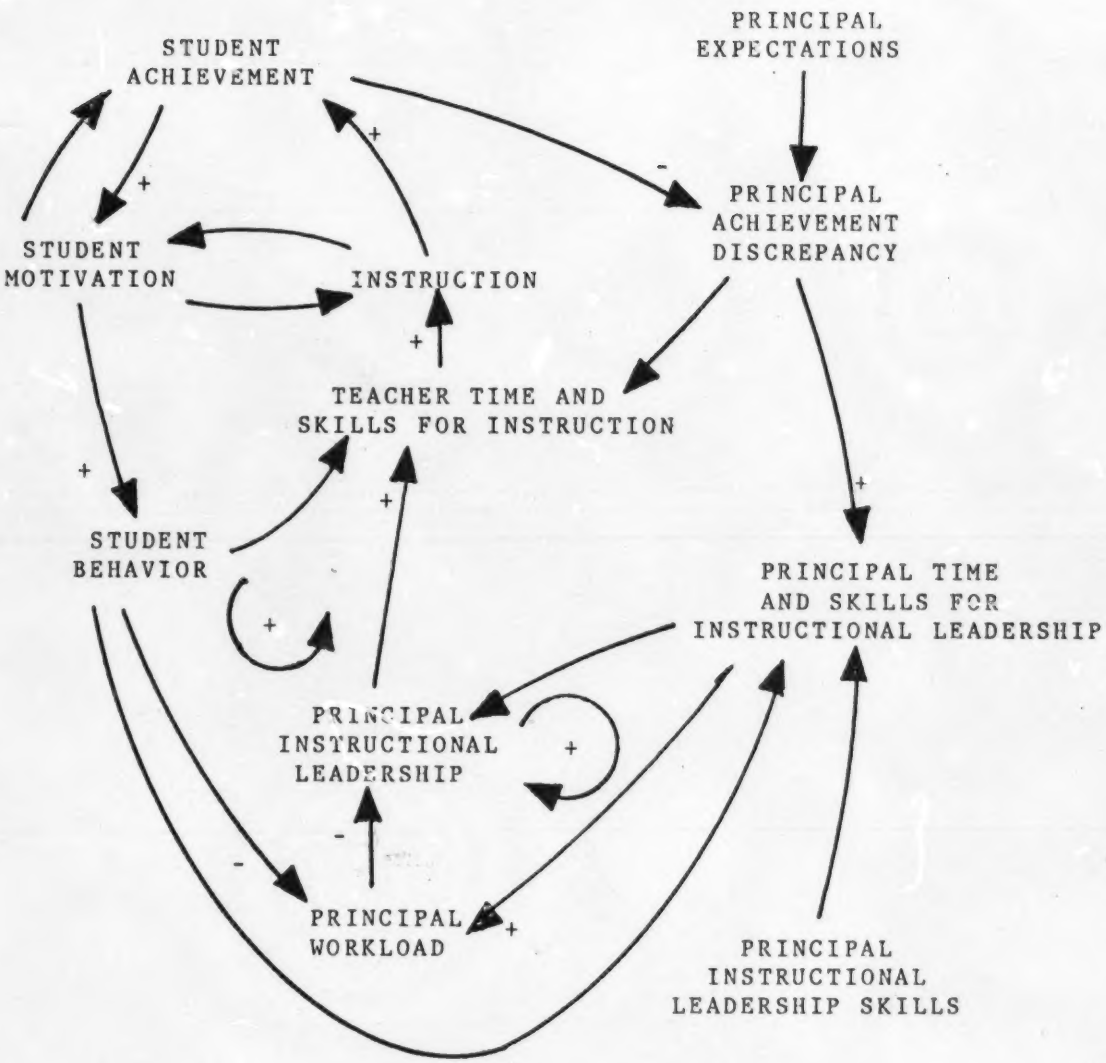

Fig. 12. Impact of Principal Workload.

The constraints imposed on the instructional process by teacher work load and student behavior suggest that in schools where there is a desire for increased effort and instruction (for example in a school where a significant portion of the student population is achieving at levels below normal) the staff cannot meet the challenge for more appropriate and more intense instruction without additional resources. The availability of additional resources is a function of the leadership of a principal and the reputation that the school has as an effective school. If a school is perceived as being ineffective and as having a weak

principal, it will be extremely difficult to acquire additional resources. On the other hand, if the school has a commitment to being effective, if it has strong leadership and if it has demonstrated success in improving student achievement, then the school would be more likely to acquire the kinds of resources it needs. (Burruss, 1978) These additional dynamics are illustrated in Fig. 13.

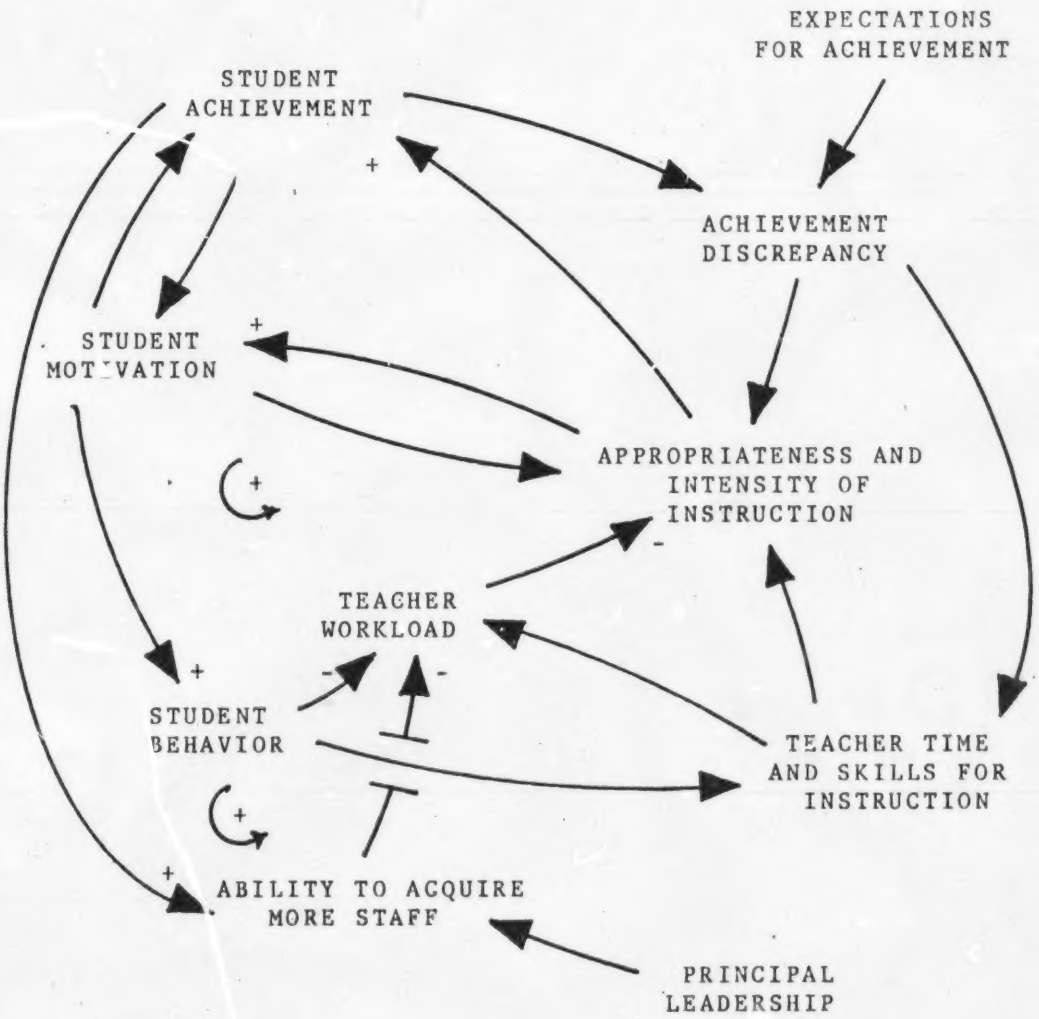

Fig. 13. Effect of Additional Staff on Teacher Workload.

The final element in our model of effective schooling concerns the transition from an ineffective to an effective school The perceived effectiveness of the school depends on conditions within the school. Consistent with our definition of an effective school, effectiveness depends on the ability of the school to close the gap in reading achievement between initially low-achievers and initially average-achievers. School effectiveness, as perceived by the staff and the community, not only depends on success in closing the achievement gap but also is affected by the strength of principal leadership and the quality of the organizational climate as captured, for example, by workload pressures.

A school that is moving toward effectiveness is one in which reading achievement for initially low achievers is rising. It is attracting new staff who are committed to an effective school philosophy and who have the necessary skills to accomplish those goals. It has strong leadership. It has a reasonable workload so that teachers and the principal are not "burned out". It has an orderly, quiet atmosphere where discipline is enforced. And, finally, it has rising teacher expectations for low achievers (cf. Edmonds, 1979 & Phi Delta Kappa, 1980). These changes trigger an upward spiral where success leads to more success. This feedback structure can also operate in a downward spiral. Declining student achievement leads to declining school effectiveness which leads to lower expectations and a further decline in achievement. (Duke & Meckel, 1980) The variables involved in the transition of the school are illustrated in Fig. 14.

The relationship between changes in perceived effectiveness and changes in teacher expectations is one we feel is crucial to the understanding of the transition process and, at the same time, one which is not very well understood. Moving a school toward effectiveness is a significant change effort. Yet the history of educational change suggests that far more efforts fail than succeed. We are currently in the process of seeking to understand and to capture more accurately in the model the major dynamics of stability and change which operate in a school within which leaders are attempting to bring about more effective ways of dealing educationally with low-achieving children. It is important to understand the contrasting conditions which facilitate different levels of staff cooperation and staff resistance. Toward this end, we are currently arranging a series of interviews with researchers and practitioners who have observed or experienced these dynamics.

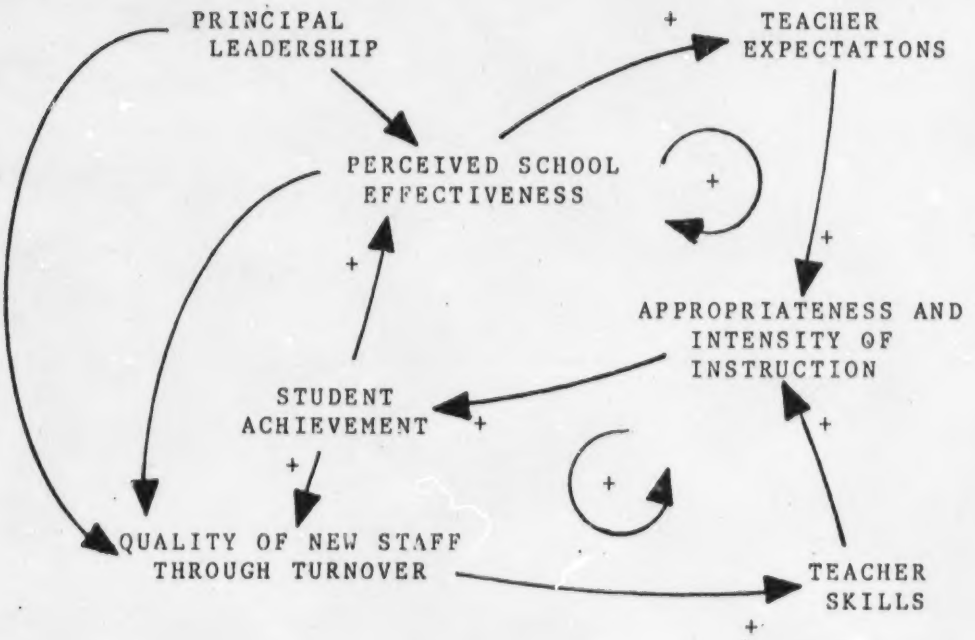

Fig. 14. Impact of Perceived School Effectiveness.

Fig. 15 illustrates the model in its entirety. The basic instructional process loop is surrounded by the additional feedback loops that shape the instructional process and which have already been discussed.

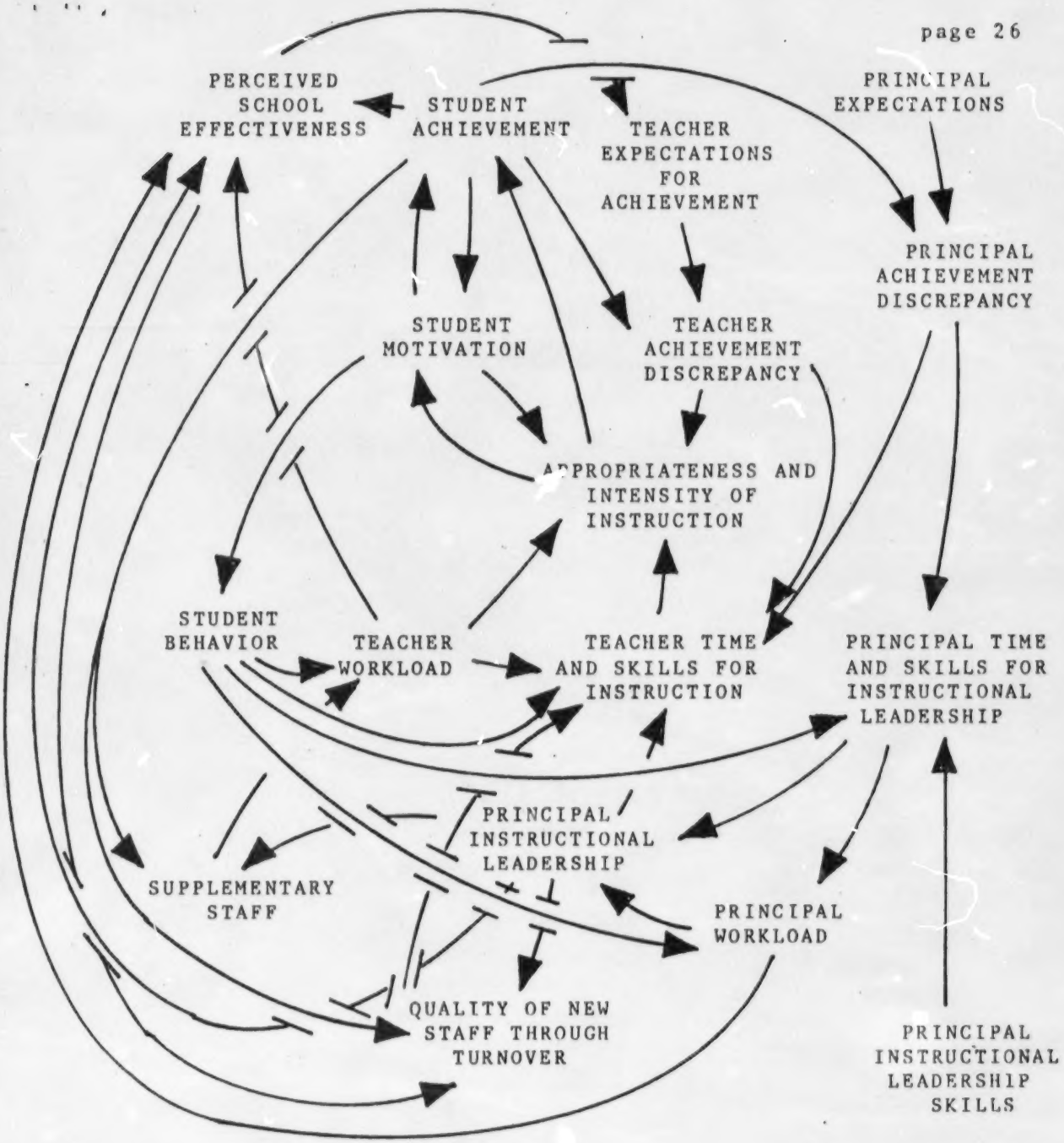

Fig. 15. General Structure: Effective Schooling Model.

These diagrams illustrate the instructional process and the effects of school as if there were only one homogeneous

group of students in the school. We feel that it is important to distinguish among the different achievement groups that are, in reality, a part of every school. Consequently, the basic structure for instruction involving student achievement, motivation, the appropriateness and intensity of instruction, teacher expectations, principal expectations, and teacher time and skills for instruction are all replicated for each of the three different achievement groups. The purpose of this is to allow us to analyze the impact of different expectations for different achievement groups and the allocation of different amounts of instruction to these groups within the school. As previously mentioned, a number of researchers stress the importance of this "microlevel" perspective on resource allocation (cf. Brown & Saks, 1980; Harnischfeger & Wiley, 1976; Thomas, 1977). The model is also constructed to encompass interaction effects among the different achievement groups which represent peer influences of students on other students and the competition among achievement groups for teacher time, teacher skills and principal support.

The model makes some simplifying assumptions about schools and the instructional process. The first assumption is that the focus of the model is on the management of human resources within the school environment. We have not focused on the role of instructional materials. We have assumed that there are sufficient instructional materials to support whatever level of instruction is required for a particular achievement group. It is our contention that schools have differential impacts on students even with this simplifying assumption.

Second, we have made no distinction between teaching staff and professional support personnel or para-professionals. We have viewed staff as having a variety of duties to perform and have assumed that all staff perform these duties.

Third, we have focused on the school as an essentially isolated unit. We assume that the school, whether we model it as an effective or ineffective school, receives the same per pupil expenditures and has the same initial student/staff ratio. Efforts on the part of the principal to acquire additional staff represent the utilization of alternative channels for funding (for example, federal grants, community and business support, parent volunteers, special school district funds, etc.).

Fourth, the model is concerned with the behavior of the school as a whole and does not focus on individual students or cohorts of students as they move through the school. The reference behavior of the second-stage model is shown in Figure 2. It is concerned with changes over time in average

sixth grade reading scores for the different initial achievement groups.

Fifth, the model does not attempt to portray the instructional process with the kind of detail represented in the research on teacher effectiveness. We have not tried to model explicitly individual teachers or differences among classrooms. We have viewed teachers and instruction at a more aggregate level. Our model of effective teaching of basic reading skills is that of "direct instruction". (see footnote [3], Supra., p. 8) The skills that are referred to in this model are the skills necessary to provide direct instruction in basic reading competencies.

Sixth, we assume that there are no necessary differences among the three achievement groups with regard to innate ability, sex, race, or socioeconomic status. We believe that the feedback structures we describe will generate the diverging achievement patterns without positing differences of these kinds among the groups and without assuming any effects of such differences except as they may be reflected in the initial achievement differences, themselves (Salganik, 1980).

Seventh, we have focused on student academic motivation rather than on general motivation and have not included effects of parents other than assuming that family background may have contributed to the initial differences in reading readiness. This is not to say that parents are unimportant. Rather, we believe that the responsibility for making schools effective lies with the educators, not the parents. The assumption is that parents are not crucial in making an effective school; however, this assumption does not seek to deny that parents can contribute, positively or adversely, to the efforts of the school staff.

Eighth, we have limited ourselves to cognitive outcomes (in reading basic skills) measured by standardized reading tests because most of the research has been done in this area and because we believe in the primary importance of mastery in reading for all school work. Research suggests that other methods of instruction besides direct instruction may be more appropriate at higher grade levels or for different outcomes (Gower & Saphier, 1980; Peterson, 1979).

Finally, the model also tracks, in a simplified way, the effects of reading and of alternative policies of resource allocation on achievement in other instructional areas. This dimension of the model tracks (1) the short-term negative impact on achievement in other subjects of policy decisions to reallocate instructional time to reading and (2) the long-term positive impact of rising reading achievement on student performance in other content areas.

Either through experimental designs or statistical techniques, educational researchers examine problems by controlling all but a few variables. This pattern of research closely resembles that of the physical scientist. Similarly, the simplifying assumptions described above imply the control of potentially confounding variables that we are controlling in order to concentrate on what the literature suggests are those variables which are both critical contributors to the dynamics of effectiveness in schools and potentially alterable (Bloom, 1980) by those charged with managing schools. Casting the theory as a computer simulation model allows us to vary and isolate components of the feedback structure systemmatically, in the manner of controlled laboratory experiments.

The work is as yet incomplete. The second-stage model has been programmed, but some technical and some conceptual issues remain as yet unresolved. The major thrust of the second-stage effort is upon policy analysis, which must await the completion of model testing. It is anticipated that this work will be completed soon and reported in the near future.

SUMMARY

The focus of the current work has been upon the dynamics of effective schooling. The theory described suggests that the essential difference between effective and ineffective schools resides in their contrasting responses to declining student achievement.

Effective schools are characterized by persistently high expectations for all, except clearly exceptional, children. Ineffective schools are characterized by teacher and principal expectations which drift downward for low-achieving students. The result is that effective schools tend to provide instruction which is appropriate and increasingly intense for low-achieving students, whereas ineffective schools are characterized by increasingly less intense and less appropriate instruction for these students.

The theory also suggests that there are important organizational properties which distinguish effective from ineffective schools. These include differences in the strength of the principal's leadership, the allocation of staff time, staff development, staff turnover, and the ability of the school to attract quality staff and additional resources.

Further efforts in this project will focus on analyzing alternative policies of transition from ineffective to effective schooling. Our aim is to add incrementally, along with others, to useable knowledge about the management of

this transition. Such knowledge seems especially critical at a time of growing crisis--economic and pedagogic--in the schools.

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